

METHOD OF DICING A WAFER

DESCRIPTION

Background of Invention

[Para 1] 1. Field of the Invention

[Para 2] The present invention relates to a method of dicing a wafer, and more particularly, to a method that allows automatic wafer expansion and wafer sorting after dicing the wafer.

[Para 3] 2. Description of the Prior Art

[Para 4] In the fabrication of semiconductor chips or MEMS chips, a wafer is first treated with tens or more than hundreds of processes to form a plurality of semiconductor devices or MEMS devices. The wafer is subsequently diced by a dicing process to form a plurality of dies. The dies are thereafter packaged so as to form a plurality of chips able to be electrically connected to printed circuit boards.

[Para 5] Please refer to Fig.1, which is a schematic diagram illustrating a conventional method of performing a dicing process with a dicing apparatus. As shown in Fig.1, a wafer 10 to undergo a dicing process is bonded to a bonding layer 12, such as a tape. The bonding layer 12 meanwhile is bonded to a supporting frame 14 so as to fasten the position of the wafer 10. When the wafer 10 is accurately aligned in the dicing apparatus, a cutter 16 is exploited through predetermined scribe lines to segment the wafer 10 into a plurality of dies 18. Selectively, a wafer expansion process can be performed according to the dimension of the scribe lines by expanding the bonding layer

12, so as to enlarge the gap between two adjacent dies 18 for the convenience of a further wafer sorting process.

[Para 6] The above method is the most common way to dice the wafer 10. However, since the width of the cutter 16 is no longer ignorable as the critical dimension of semiconductor processes decreases, the dicing process using the cutter 16 is no longer able to dice a wafer with high integration. Therefore, a dicing process by way of etching is another choice.

[Para 7] Please refer to Fig.2, which is a conventional method of performing a dicing process in an etching manner. As shown in Fig.2, a wafer 30, having a photoresist pattern 36 disposed thereon for defining scribe lines, is bonded to a carrier 34 with a bonding layer 32. Then, an anisotropic etching process is performed to etch the wafer 30 uncovered by the photoresist pattern 36 until the wafer 30 is etched through so as to form a plurality of dies 38.

[Para 8] The above method is able to reduce the dimension of the scribe lines so as to increase the amounts of dies 30 arranged in the wafer. However, due to the narrowness of the scribe lines, the wafer sorting process cannot be easily performed after the dicing process. In addition, since the carrier 34, such as a bare wafer, is a rigid structure, the wafer expansion process in which the bonding layer 32 is extended to increase the gap of the dies 38 cannot be carried out. In such a case, the photoresist pattern 36 is removed in advance, and then the bonding layer 32 is removed to separate the dies 38 from the carrier 34. Following that, the dies 38 are picked up and sorted manually. Accordingly, the throughput is reduced and the dies 38 may be damaged.

Summary of Invention

[Para 9] It is therefore a primary object of the claimed invention to provide a method of dicing a wafer to overcome the aforementioned problems.

[Para 10] According to the claimed invention, a method of dicing a wafer is disclosed. First, a wafer supported by a carrier is provided where a bonding layer and an extendable film are disposed in between the carrier and the wafer. Then, a photoresist pattern is formed on a surface of the wafer to define scribe lines of the wafer. Following that, an anisotropic etching process is performed to remove the wafer uncovered by the photoresist pattern to form a plurality of dies. Finally the bonding layer is separated from the carrier.

[Para 11] The present invention utilizes a bonding layer and an extendable film to bond the wafer and the carrier, and separates the bonding layer from the carrier without harming the extendable film (e.g. by heating or irradiating) after the dicing process. Consequently, an automatic wafer expansion process can be directly carried out to increase the gap between adjacent dies for the convenience of following die sorting and placing (welding) processes.

[Para 12] These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment that is illustrated in the various figures and drawings.

Brief Description of Drawings

[Para 13] Fig.1 is a schematic diagram illustrating a conventional method of performing a dicing process with a dicing apparatus.

[Para 14] Fig.2 shows a conventional method of performing a dicing process by etching.

[Para 15] Fig.3 through Fig.8 are schematic diagrams illustrating a method of performing a dicing process according to a preferred embodiment of the present invention.

Detailed Description

[Para 16] Please refer to Fig.3 through Fig.8. Fig.3 through Fig.8 are schematic diagrams illustrating a method of performing a dicing process according to a preferred embodiment of the present invention. As shown in Fig.3, a carrier 50, e.g. a bare wafer, is provided, and a bonding layer 52 and an extendable film 54 are consecutively formed on the surface of the carrier 50. The extendable film 54 is an extendable and adhesive film, such as a plastic tape. The bonding layer 52 is a heat sensitive tape which can be removed by heating, a UV tape which can be removed by UV curing, or other material which can be easily removed without harming the adhesion of the extendable film 54.

[Para 17] As shown in Fig.4, a wafer 56 is then adhered and fastened to the surface of the extendable film 54. As shown in Fig.5, a photoresist layer (not shown) is disposed on the wafer 56, and an exposure and development process is subsequently performed to form a photoresist pattern 58 so as to define the scribe lines on the surface of the wafer 56. As shown in Fig.6, an anisotropic process, such as a dry etching process, is thereafter performed to etch the wafer 56 uncovered by the photoresist pattern 58 until the wafer 56 is etched through, so as to form a plurality of dies 60.

[Para 18] As shown in Fig.7, the photoresist pattern (not shown) is stripped. Following that, the bonding layer 52 is removed so that the

extendable film is separated from the carrier 50. The step of separating the extendable film 54 from the carrier 50 is based on the characteristic of the bonding layer 52. For example, if a heat sensitive tape is utilized as the bonding layer 52, the extendable film 54 and the carrier 50 are separated by heating. It is appreciated that the melting point of the extendable film 54 must be higher than the melting point of the bonding layer 52 so that the adhesion of the extendable film 54 is maintained. Otherwise, the dies 60 may be loosened from the extendable film 54. On the other hand, if a UV tape is utilized as the bonding layer 52, the extendable film 54 and the carrier 50 are separated in an irradiation manner, such as by UV curing.

[Para 19] As shown in Fig.8, after the extendable film 54 is separated from the carrier 50, the extendable film 54 can be easily extended due to its extendable characteristic. Consequently, an automatic wafer expansion process can be directly implemented to increase the gap between adjacent dies 60, and therefore a following automatic die sorting and die placing process can be carried out without any difficulties.

[Para 20] It can be seen that the method of dicing a wafer according to the present invention utilizes a bonding layer and an extendable film to bond the wafer and the carrier, and separates the bonding layer from the carrier without harming the extendable film (e.g. by heating or irradiating) after the dicing process. Consequently, an automatic wafer expansion process can be directly carried out to increase the gap between adjacent dies for the convenience of subsequent die sorting and placing processes.

[Para 21] In comparison with the prior art, the dicing process of the present invention is implemented by anisotropic etching, and thus the dimension of the scribe lines is more refined. In addition, the method of the present invention allows directly performing an automatic wafer expansion process and an automatic die sorting process. On the contrary according to

the conventional method, the wafer expansion process must be carried out manually, thereby reducing the yield and prolonging production time.

[Para 22] Those skilled in the art will readily observe that numerous modifications and alterations of the device and method may be made while retaining the teachings of the invention. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.